Volume 39 July, 1953 *Number 7*

Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants

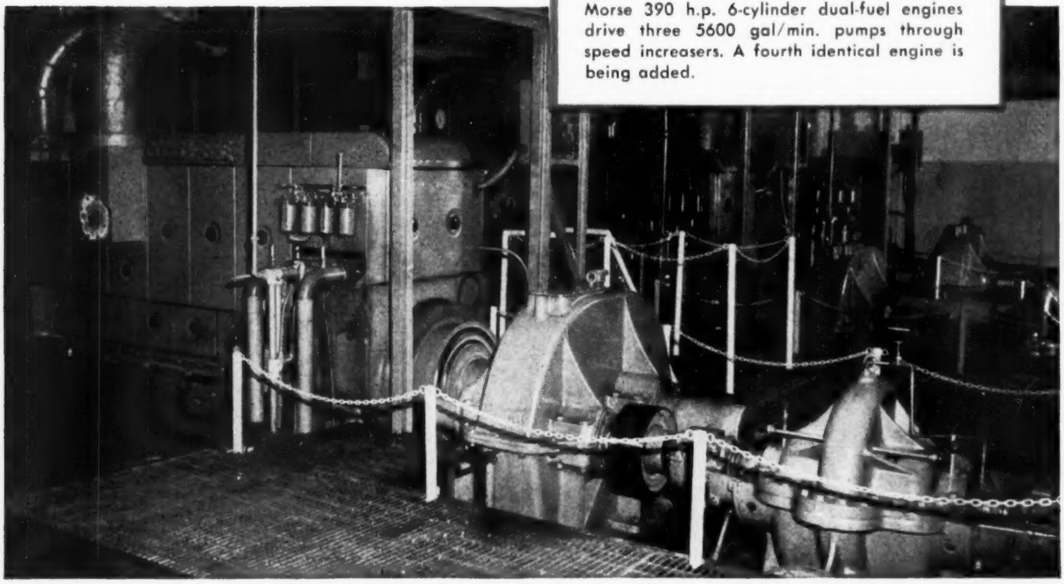
THIS ISSUE

LUBRICATED
FLEXIBLE
COUPLINGS

PUBLISHED BY
THE TEXAS COMPANY
TEXACO PETROLEUM PRODUCTS

How San Antonio's Mission Pumping Station assures FREE RINGS

MODEL OF EFFICIENCY. Mission Pumping Station supplies water to the south side of the city of San Antonio. Three Fairbanks-Morse 390 h.p. 6-cylinder dual-fuel engines drive three 5600 gal/min. pumps through speed increasers. A fourth identical engine is being added.



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LUBRICATION

A TECHNICAL PUBLICATION DEVOTED TO THE SELECTION AND USE OF LUBRICANTS

Published by

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LUBRICATED FLEXIBLE COUPLINGS

Direct connected machinery today requires flexible couplings. When power transmission machinery was operated at relatively slow speeds and the same base foundation was used the shafts connecting the engine to the driven element could often be coupled together by a conventional flange coupling. Some misalignment might develop, it is true, to result in bearing wear and increased power consumption but the relatively massive construction of the machines usually enabled them to carry on without much trouble.

Increase in speed, however, which accompanied the development of the steam turbine, and the extended usage of electric motor power required careful study of means of coupling together the driving and driven units. The importance of coupling flexibility was further accentuated by the trend to increase the power-to-weight ratio, and range of power output. The coupling turns at the same speed as the connected shafts. When alignment is close the coupling elements exert a relatively small amount of movement with respect to each other. This is an ideal which obviously cannot always be expected. Accordingly the modern flexible coupling is designed to transmit power over a wide range, under sustained overloads, to be able to absorb shocks or vibration, and to compensate for both axial, angular and parallel misalignment. Modern power transmitting installations are designed for as nearly perfect alignment as possible. Then the load on the flexible coupling is minimum, but due to structural conditions more or less misalignment must be expected after the machine goes into operation. The coupling must anticipate this and modern flexible couplings are designed accordingly.

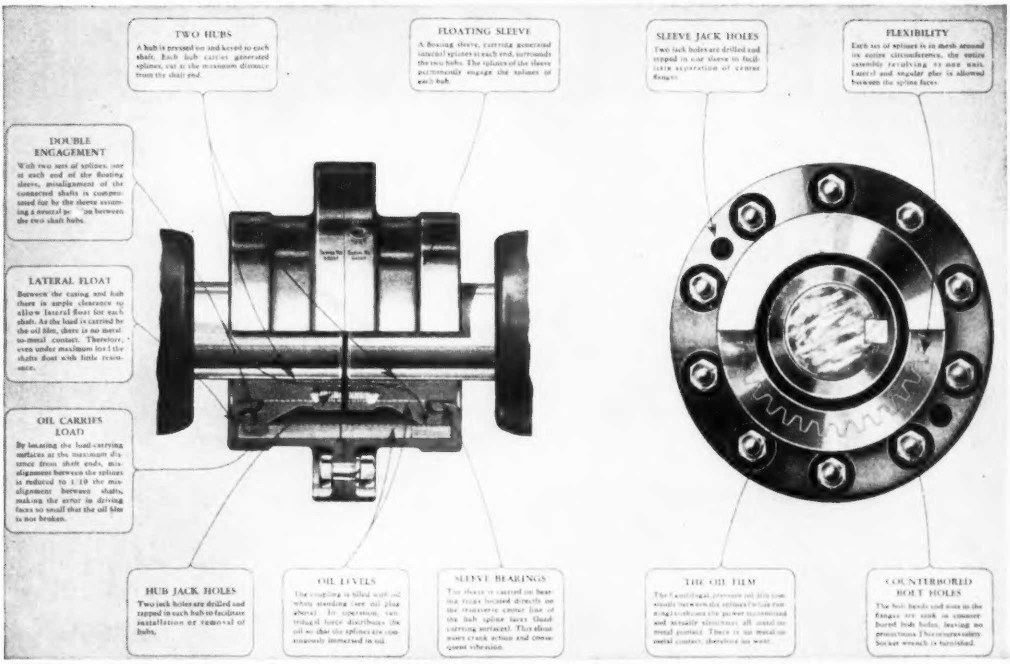
FLEXIBILITY IN SERVICE

Flexible couplings as originally designed derived their flexibility through the use of flexing materials such as springs, rubber bushings or laminated pins. Later, the mechanical type of coupling was designed, involving rigid parts such as illustrated in some of the accompanying designs.

When the mechanical type coupling came into use the need for lubrication became apparent. Lubrication is important in order to keep the contact elements in the coupling as free from friction and wear as possible. In this way their degree of relative flexibility will be maintained. This type of coupling is of particular interest to the lubrication engineer as he must decide upon the type of lubricant most suitable according to the design of the coupling, how it is installed and the prevailing operating conditions.

LUBRICATION PREVENTS OVERHEATING

While a perfectly aligned coupling is a theoretical possibility, it is virtually never obtained in practice. Accordingly the possibility of overheating must be considered because it is a fundamental feature of any type of coupling that it develops heat under



Courtesy of Koppers Company, Inc.

Figure 1 — Showing the principles and features of the Fast Self-Aligning Coupling. The outstanding feature of this design is positive lubrication. In operation the load carrying surfaces are entirely submerged in lubricant.

misaligned conditions as a result of power absorption in overcoming the misalignment. The amount of heat developed, or power absorbed, of course, will depend upon the loads, the rubbing velocities of the contact parts and the ability of the lubricant to keep the coefficient of friction between these parts (such as the teeth in a gear type coupling) at the lowest possible figure, but most importantly, upon the degree or amount of misalignment.

Heat is rejected by conduction, radiation, and convection from the coupling members themselves, or by the circulation of the lubricating oil, which in this case doubles as a coolant. The ultimate temperature of the coupling is then determined by the difference between the rates of heat generation and rejection. It is important to recognize this possibility of heat generation and the fact that a coupling lubricant does more than serve only as a medium by which the tooth surfaces (for example) are separated to prevent wear. In reality the lubricant is the only factor which can be altered to reduce the final operating temperature in a coupling operating at high misalignment and high speed without making mechanical changes. This is of prime importance in steam and gas turbine applications.

Effective lubrication therefore is a pre-requisite if any type of lubricated coupling is to take care of the operating conditions. The life of such a coupling is virtually contingent upon the use of suitable lubricants and the extent to which these can be contained in the coupling. Suitable lubricants plus good seals go a long way in preventing coupling wear. A flexible coupling represents only a very small fraction of the cost of the power generating or transmission unit to which it is attached, but this is a very vital fraction since the performance of the coupling is a measure of the reliability of the machinery which it connects.

Just as the coupling is but a small part of the machinery investment, so is the cost of the amount of lubricant required, a very small part of the initial cost of the coupling.

TYPES OF COUPLINGS

Flexible couplings which are designed for lubrication involve meshing annular gear teeth, flexible steel grids or springs, an arrangement of roller or link type chains or an intermediate floating element in the form of a cross. Lubricated couplings in turn are divided into two broad classifications as to whether they are lubricated by oil or grease. Couplings depend fundamentally on mechanical design for their flexibility.

GEAR TYPE COUPLING

When two single engagement couplings are combined into one element the device is considered as involving the principle of "double engagement."

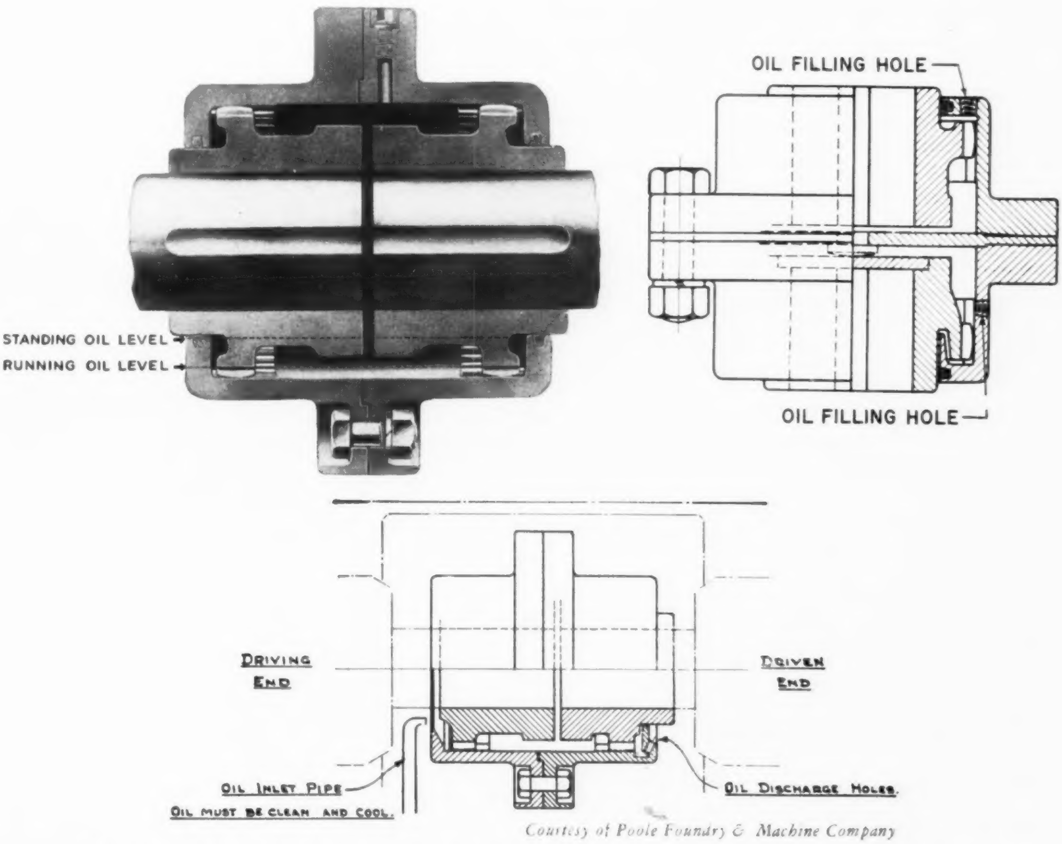
Two sets of internal and external spur gearings are involved in this type coupling. The teeth of the external elements are cut on the two hubs which are pressed and keyed to each shaft. The internal teeth are cut in the surfaces of two companion floating sleeves; in operation they mesh permanently around the entire circumference with the gear teeth on each hub. By virtue of the design and the existing clearance between the ends of the sleeves and the hubs, the shafts are subject to free adjustment. Yet, the shafts and sleeves revolve as one unit, the enmeshed gears compensating for any lateral or angular play.

Another design employs internal teeth at each end of a floating sleeve which mesh with corresponding sets of external spur teeth cut on the end of each shaft hub. Spherical formation of the teeth of these latter enables free rocking action according to shaft misalignment requirements. These gears are permanently in mesh around the entire circumference, giving the maximum of load-carrying capacity.

The method of sealing couplings of this latter type against entry of dust, dirt, grit or moisture is of distinct interest. A highly resilient type of oil-resisting packing ring seal is inserted in a tapered groove between the end plate and hub at each end of the coupling. It is claimed that such a seal does not impair flexibility; at the same time it aids retention of oil and exclusion of foreign matter. As a result, carrying high oil level should not lead to leakage.

Lubrication Requirements

By reason of the fact that constantly enmeshed gear teeth are involved, positive lubrication is a most important factor in the development of proper operation. It may even be stated that the design of such couplings has been predicated upon effective lubrication. Normally this is brought about by



Courtesy of Poole Foundry & Machine Company

Figure 2 – Details of a Poole flexible coupling at left. Drawing at right shows a vertical adaptation, and below is a sectionalized view of a continuous lubricated type.

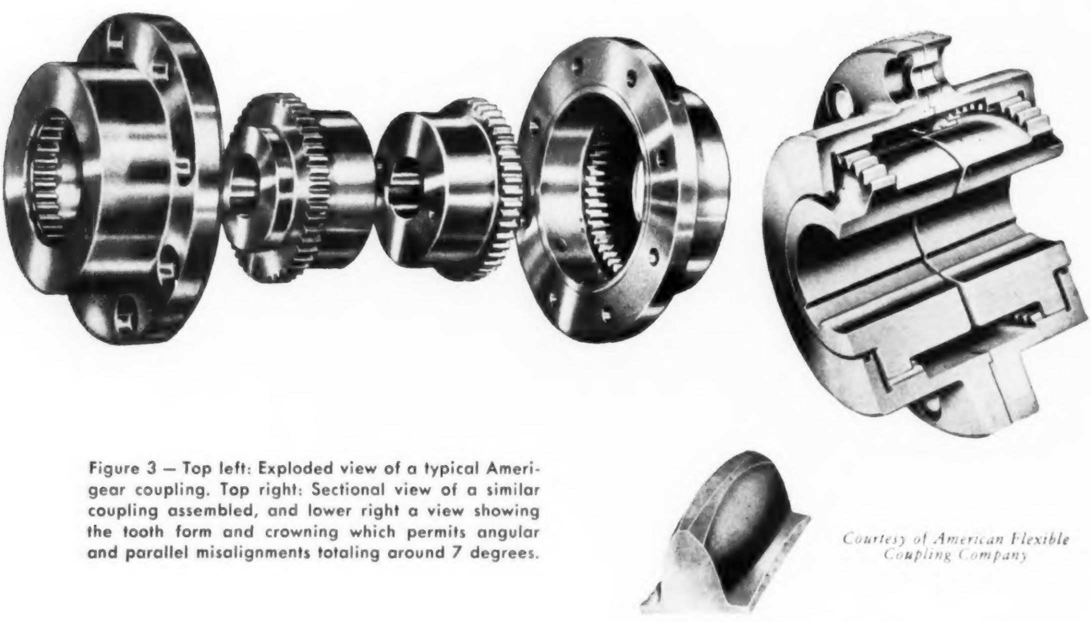


Figure 3 — Top left: Exploded view of a typical Ameri-gear coupling. Top right: Sectional view of a similar coupling assembled, and lower right a view showing the tooth form and crowning which permits angular and parallel misalignments totaling around 7 degrees.

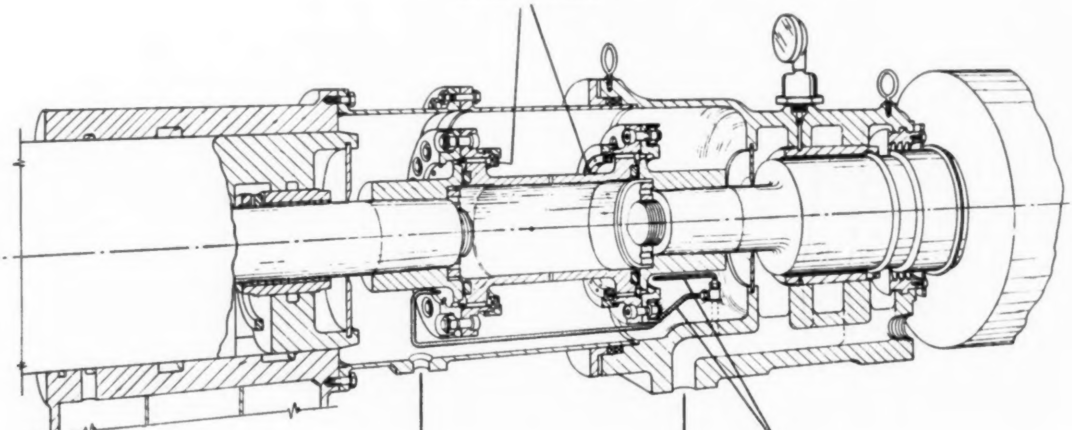
Courtesy of American Flexible Coupling Company

merely charging the coupling to a pre-determined level with a suitable grade of oil or grease in accordance with the prevailing service. Usually re-lubrication once every six months will suffice.

In operation of an oil lubricated coupling, continued maintenance of an adequate oil film between the gear teeth is brought about by pumping action between the load carrying surfaces, in company with centrifugal force and capillary action. The speed of rotation will affect the pressure involved due to its relation to centrifugal force. By reason of the variation of alignment this pumping action causes circulation of a renewed supply of oil to the load carrying surfaces twice during each revolution. This is virtually positive insurance against any lack of lubrication provided a sufficient amount of oil is maintained in the coupling.

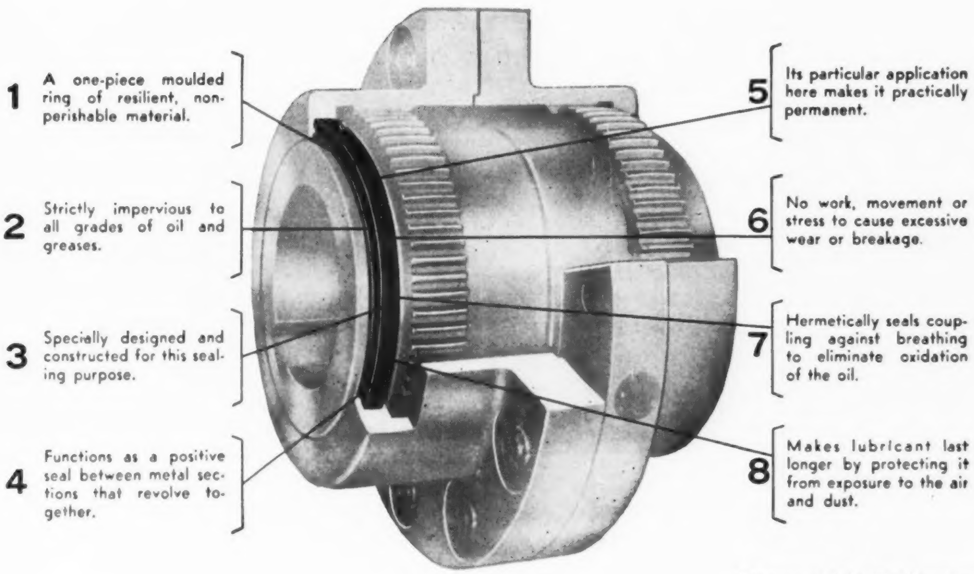
Type of Oil

The viscosity of oil to use in a gear-type coupling designed for oil will be governed by the operating conditions. The normal range will be from approxi-



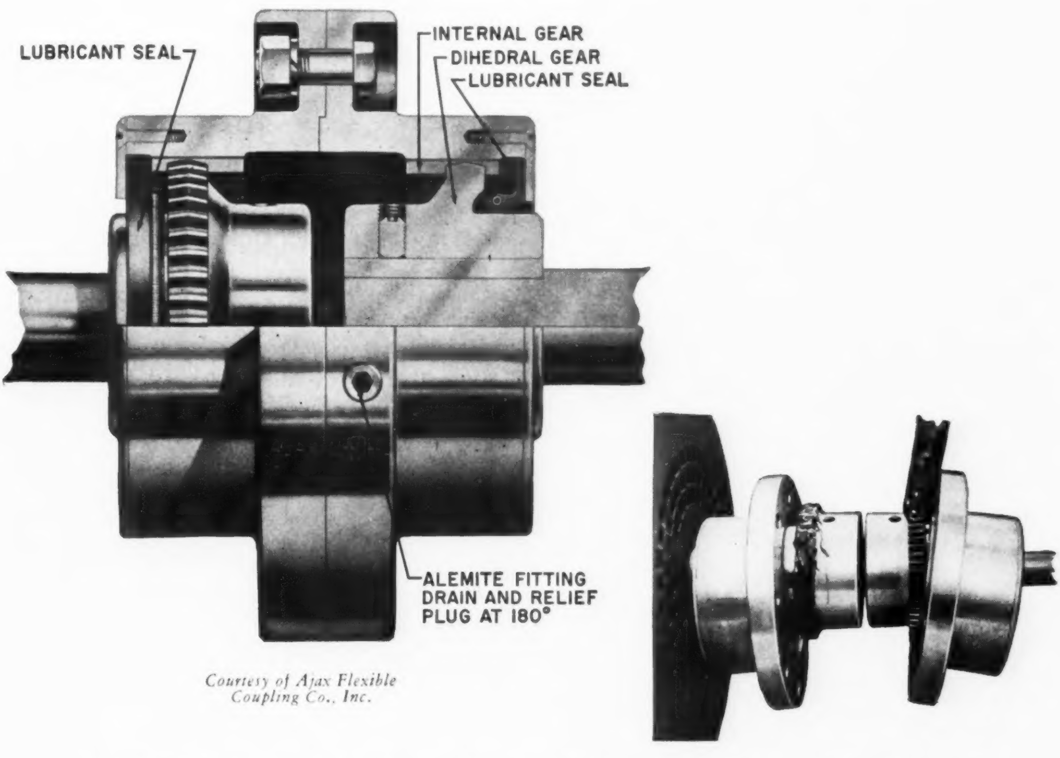
Courtesy of De Laval Steam Turbine Company

Figure 4 — View of a De Laval gear type spacer coupling showing installation and provision for continuous lubrication.



Courtesy of John Waldron Corp.

Figure 5 — The Waldron gear coupling showing details of the Walflex seal.



Courtesy of Ajax Flexible Coupling Co., Inc.

Figure 6 — The Ajax Dihedral flexible coupling showing lubricant seal, and manner in which grease lubrication can be applied at the time of mounting (see view at right). In operation at regular intervals, according to the type of service, the relief plug should be removed and grease added by pressure gun. The amount is not critical as long as enough is in the coupling to cover all the teeth.

mately 100 to 1000 seconds Saybolt at 210 degrees Fahr., in other words, one would use a product ranging in body from that of an extra heavy motor oil to a heavy gear lubricant. It will all depend upon the size of the coupling and the temperature of operation.

In northern climates, cold weather service would require an oil within the lower viscosity range, or even one lower than 100 seconds Saybolt at 210 degrees Fahr., whereas in certain steel or cement mill operations a heavy gear lubricant would be necessary in view of the viscosity-reducing effects of high temperatures.

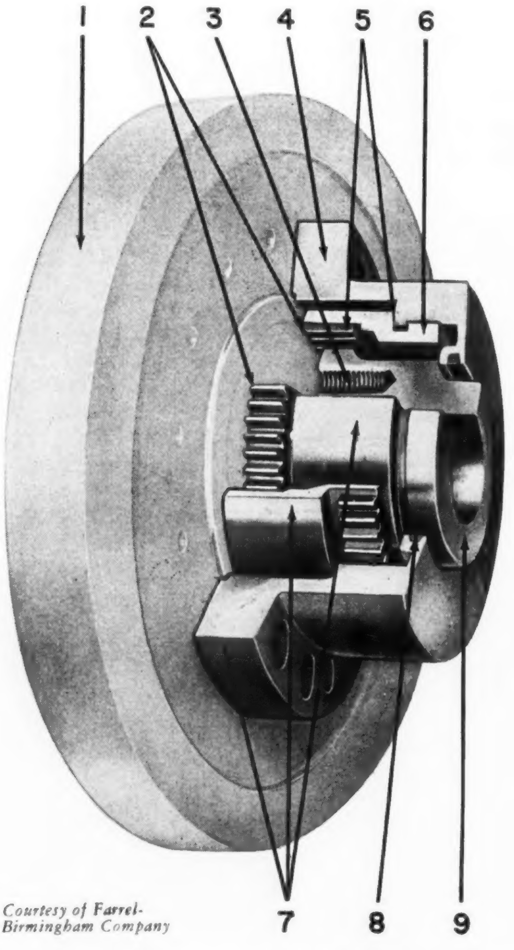


Figure 7 — Cutaway view of a Farrel Manger coupling bolted to a flywheel. 1. Indicates the flywheel; 2. the external and internal gear teeth; 3. tapped holes to facilitate assembly and disassembly; 4. the flanged outer sleeve; 5. the wide face of the internal gear teeth; 6. the compensating member which provides connection between hub and outer sleeve; 7. all steel parts finish-machined to close tolerances; 8. the durable flexible oil resistant packing which retains oil inside the coupling; and 9. the geared hub keyed to the shaft.

Grease Lubrication

In contrast with the above there are other types of gear couplings which are intended for grease lubrication. The basic idea is the same—to insure that a film of lubricant is continually maintained on the gear teeth to prevent wear. The means of application and renewal however, differ. Oil-lubricated couplings are filled or re-filled from an oil-hole in the housing which can be plugged during operation to prevent throw-out of oil. With a grease lubricated coupling there is provision for application by a pressure gun when the coupling is in service. When it is being assembled grease is often smeared on the gear teeth to insure a good initial coating when it goes into operation.

Choice of the most suitable type of grease becomes a problem when high speed couplings or low temperature operation is required.

In the case of high speed units the potential effect of centrifugal force must be considered with resultant possibility of soap being separated mechanically from the oil content. To translate this possibility of separation into figures which are developed by centrifuge operation it is interesting to note that a centrifuge of 18 inches diameter running at 6,000 R.P.M. will develop a centrifugal force of 10,000 times gravity; one running at 17,500 R.P.M. will develop a centrifugal force of 20,000 times gravity. A properly compounded sodium soap grease containing a highly refined mineral oil of from 90 to 150 Seconds Saybolt Universal viscosity at 210 degrees Fahr. has been found to effectually resist soap migration under these speed conditions in laboratory tests run for periods up to 8 hours. Continued research is going on to determine what the maximum limits might be for speed, temperature and time.

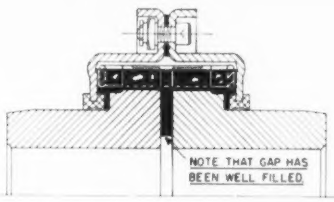
Conversely, at low speeds there may be some question at times as to the ability of the relatively low centrifugal force to effectually distribute grease over all the tooth surfaces. For this reason the relative adhesiveness of any prospective grease must be studied.

STEEL GRID OR SPRING TYPE

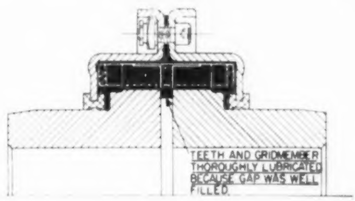
Couplings of this double engagement type derive their flexibility from the action of forged alloy steel grids on curved toothed steel hubs. Fig. 9 illustrates an assembled coupling of this type and shows how the gridmember is inserted in the curved slots of the two opposing hubs. The grid fits snugly in the grooves with sufficient clearance to provide for a rocking and sliding action to accommodate parallel and angular shaft misalignment and end float.

The cross section of the grid and radius of the slot is designed to maintain a constant stress on the grid as it bends and wraps around the tooth as required to smooth out variations of torque load

Proper way to fill Falk Steelflex couplings with grease

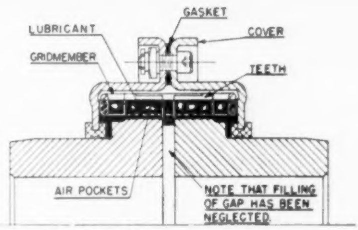


View showing coupling properly filled with grease. Air pockets have been practically removed by careful packing, and gap between hubs has been entirely filled.

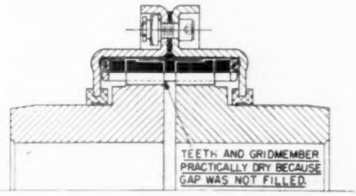


Grease in the gap acts as a reservoir when coupling is rotating and fills the empty spaces between the teeth and grid when thrown outward by centrifugal force.

What happens when coupling is improperly filled with grease



View showing coupling improperly filled with grease. Notice air pockets and empty space between hubs.



Centrifugal force, caused by rotation of coupling, throws grease outward. Notice how lubricant has been removed from rubbing surfaces, thus causing excess wear.

Courtesy of The Falk Corporation

Figure 8 — Showing how a Falk Steelflex coupling should be lubricated.

The torsional cushion thus provided minimizes the adverse effect of shock and vibration on the alignment of the connected machines.

Grease Lubrication Prevails

Grease lubrication is essential to free action of the parts in steel grid couplings. This lubricant is contained by a two-piece steel cover with a gasket between the halves and neoprene seals at the hubs. When assembling the coupling, grease is packed into the spaces between and around the grids. For proper lubrication, the coupling should be completely packed with lubricant, so that air pockets will be eliminated and a reservoir of grease provided in the space between the hubs. The action of centrifugal force on the grease will fill any small air pockets which may remain around the gridmember after assembly. In operation, a grid or spring type coupling should be lubricated at least once every six months by means of a pressure gun. In relubricating, the coupling should be vented by prying up the ring seal with a nail or small screw driver. The neoprene seals and tan fibre gasket prevent loss of lubricant and entrance of water, dust, or other foreign material.

Greases of the "all-purpose" or "multi-purpose" types recommended for general industrial use in ball and roller bearings have proven entirely satisfactory in grid type couplings. The action of the grid-groove design is such that heat developed under misalignment is insufficient to adversely affect the stability of these greases and only ambient temperatures need be considered. Generally speaking, the grease used to successfully lubricate the bearings on the connected shafts will be entirely satisfactory.

Courtesy of The Falk Corporation

Figure 9 — Cutaway view of a Falk Steelflex coupling showing neoprene seal and lubrication fitting.

Courtesy of Link-Belt Company

Figure 10 — The Link-Belt "RC" roller chain flexible shaft coupling with casings removed. This type of divided roller combines the construction of a single width chain with the advantages of a double width chain by providing independent roller contact with each of the coupling halves.

FLEXIBLE CHAIN COUPLINGS

Chain type flexible couplings may involve roller or so-called silent chains. The roller type are built with single rollers, divided or double rows of chain rollers. These mesh with sprocket teeth cut on the companion hubs to compose the flexible part of the coupling. This flexibility is developed by freedom of motion (laterally) by the sprocket teeth with respect to the chain; or in another type of chain coupling by the use of chain pins which can bend according to the extent of misalignment. All the while either type of chain connection maintains a snug fit around the sprocket teeth.

Silent link type chains are similarly meshed with sprocket teeth on the hubs, but in this type of design the teeth are somewhat wider than where a roller chain is used.

Lubrication

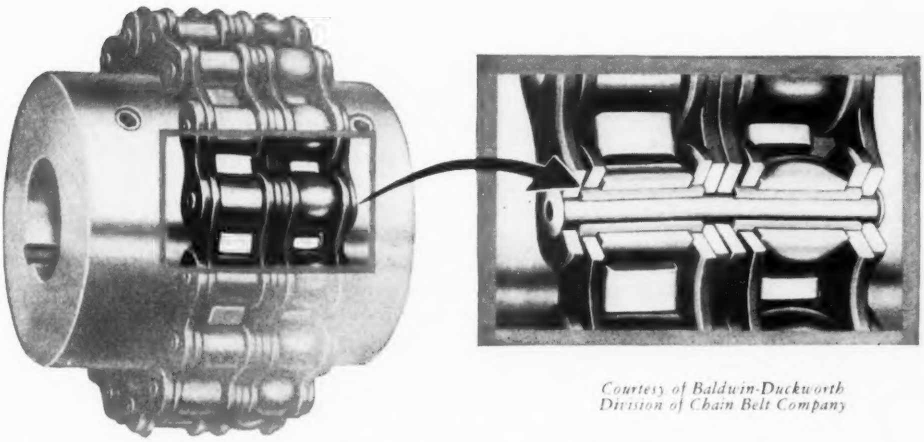
Grease is the preferred lubricant for a chain type of flexible coupling; to accommodate this and to prevent leakage the chain and hub assemblies are covered by two halves of a split casing which are securely fastened together. Steel washers and cork, neoprene or fabric sealing material are used to prevent grease leakage between casing halves. Pliable shaft sealing at the hub ends permits end float of the respective shafts according to temperature and operating conditions.

Couplings of this type usually are filled with a high quality No. 1 grade grease at the time of assembly. In service they should be refilled at regular intervals of perhaps every two or three months. The manufacturers advise *never overfilling*, otherwise leakage may result.

COUPLINGS WITH FLOATING MEMBERS

Couplings of this type derive their flexibility from their mechanical structure. A typical design involves a non-flexible floating center member which slides between opposing parallel jaws on the exterior parts of the assembly. While a floating member coupling normally involves but three parts (Figure 16), it is possible to add bearing strips to each side of the center member as an aid to lubrication. These strips being replaceable can be of softer metal than steel if desired, although this feature will depend upon the extent of load as developed by misalignment. In another type the center member is composed of a special laminated phenolic material which does not require lubrication.

A floating member coupling allows for free end movement (axially) of either or both of the shafts, and at the same time it takes care of either parallel or angular misalignment. The floating center member is lubricated along its contact sides with the jaws of the end flanges by oil or grease. A self-contained oil reservoir is incorporated in one design. In the grease lubricated type of coupling the floating member has a hollow center which the manufacturers recommend should be filled half full with a high grade medium consistency grease in the N.L.G.I. No. 2 range. In both the oil or grease



Courtesy of Baldwin-Duckworth Division of Chain Belt Company

Figure 11 — Cutaway view of a Baldwin-Rex Tru-Flex flexible chain coupling. A suitable cover serves to retain lubricant and eliminates guards and lubricating accessories. This cover may revolve or remain stationary according to the service.

lubricated coupling of this type, lubricant can be renewed through holes in the flanges or via a pressure gun fitting.

THE FLOATING KEY TYPE

The use of floating steel keys made possible another type of oil lubricated coupling of all metal construction. One design comprises two cast steel hubs, each keyed to its respective shaft. On each hub dove-tail slots are cut, wherein the steel keys are located in the final assembly. These keys float on a film of oil which is maintained by centrifugal force during rotation of the coupling. The keys are drilled to afford greater oil carrying capacity, and give more positive assurance of adequate lubrication at all times.

The number of keys used depends upon the size of the coupling. In the smaller types, three such keys are installed. Large couplings, however, are equipped with five keys. General construction of all sizes is such as to prevent entry of dust and dirt, and enable oil retention with the minimum of leakage.

Lubrication

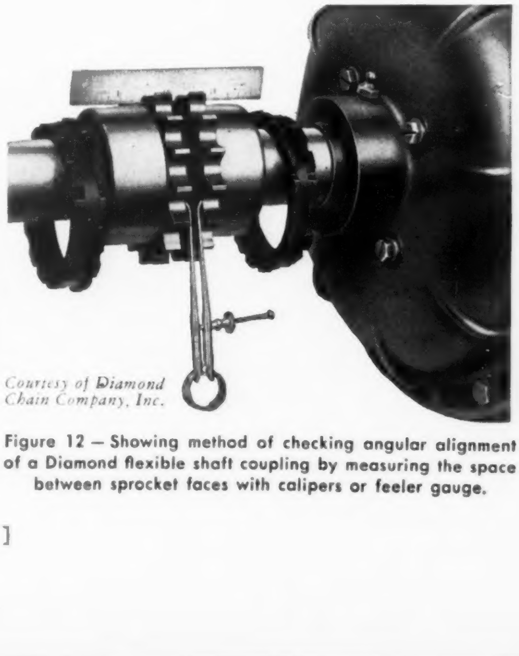
Flexible key type couplings are normally designed for oil lubrication. Circulation to and around keys is brought about by centrifugal force, the pressure developed in normal operation being sufficient to keep the clearance spaces between the keys and their respective slots completely filled with oil. There is as a result the minimum possibility of metal-to-metal contact, even under extreme conditions of misalignment.

Adequate oil distribution also facilitates more complete rocking action of the respective keys during rotation, thereby preventing localization of wear at any one point. Should extreme conditions cause metallic contact the resultant wear would be distributed along the entire side surfaces of the keys. Indication of effective lubrication is noiseless operation.

Nature of Oil

Constructional conditions of such couplings require the use of a medium viscosity, highly refined straight mineral oil, of from 300 to 600 seconds Saybolt viscosity at 100 degrees Fahr. Under low temperature operation the lower viscosity range should be used, selecting in addition an oil of as low pour test as possible to enable proper distribution when starting cold.

Provision is made for application of oil in such a coupling through a lip at one side of the casing.



Courtesy of Diamond Chain Company, Inc.

Figure 12 — Showing method of checking angular alignment of a Diamond flexible shaft coupling by measuring the space between sprocket faces with calipers or feeler gauge.

Re-lubrication normally should be carried out when the coupling is at rest, filling to the level of the lip. Such couplings should be drained, cleaned and filled with fresh oil about once a year.

PIN COUPLINGS

An interesting type of pin coupling evolved with the development of the bushed laminated pin device. In this coupling flexibility is brought about through the use of laminated steel pin units which are locked in place by a spring retaining ring in one of the flanges.

The use of such pins is regarded as providing an effective cushion where load shocks and vibration may occur.

Construction From View Point of Lubrication

The pins are inserted in bronze, graphited or oil-less type bronze wax-impregnated bushings in the flange which is opposed to the one in which the steel retaining spring is located. Where service may be severe, continuous oil lubrication is recommended by the manufacturers, the couplings being enclosed in a suitable oil retaining casing. Such enclosure with the attendant provisions for lubrication will be of particular advantage where the coupling may be exposed to acids, moisture or an excess of dust, grit or other abrasive foreign matter.

DOUBLE FLOATING RING DESIGN

An extension of the usage of flexible pins is also found in the double floating ring type of coupling. By using two sets of such pins a degree of flexibility is claimed to be attained which renders such a coupling adaptable to very severe operation, where correction of operating or structural misalignment can be accomplished only at infrequent intervals.

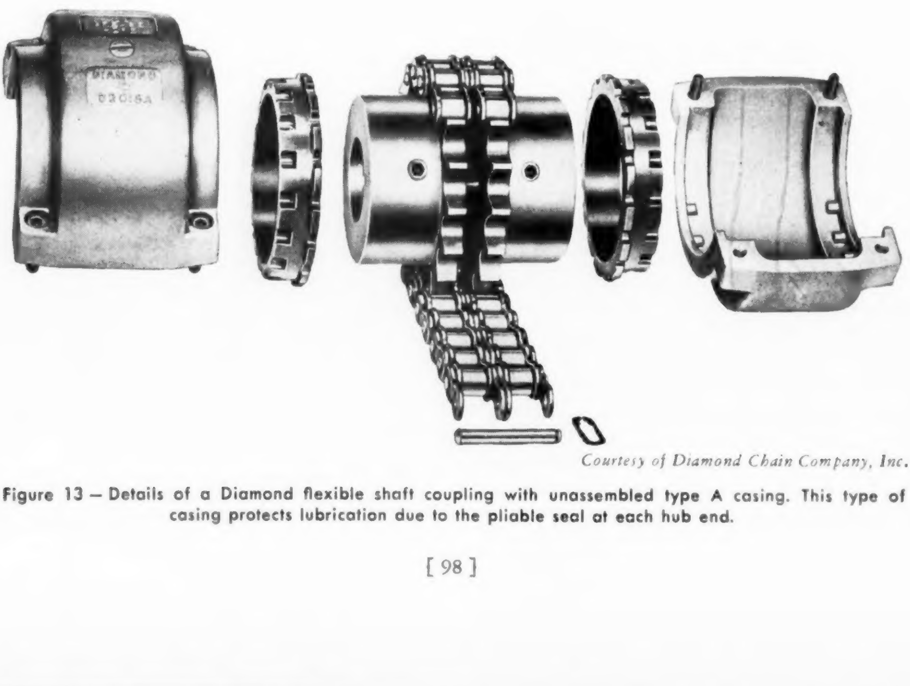
Lubrication Most Important

With the double floating ring coupling positive lubrication must be provided for, in view of the fact that the extra misalignment capacity is derived from the movement of the floating ring with respect to the two sets of pins as well as the flexibility of the laminated spring construction. For average coupling installations a medium viscosity highly refined oil has been found to be satisfactory, the oil case being filled until the oil level is nearly up to the lower rim of the coupling. This will enable the oil scoops attached to the floating ring to pick up oil continually during rotation. Oil passes through these scoops to be subsequently delivered to each flexible pin unit. It is important to remember that the holes in the oil scoops must be located in the direction of rotation of the coupling, in order to insure positive circulation of oil. Renewal of oil is advisable at regular intervals, to maintain the level in the case at the proper height.

Not all such couplings are oil lubricated however. The high speed type may require either oil or grease according to operating requirements. For this reason this type of coupling is so designed as to be capable of retaining grease, application of the lubricant being accomplished by suitable pressure gun fittings. It is practicable to install the high speed coupling in an oil case and lubricate it in a similar manner to the double floating ring type.

INSTALLATION

Initial alignment is a very important item both



Courtesy of Diamond Chain Company, Inc.

Figure 13 — Details of a Diamond flexible shaft coupling with unassembled type A casing. This type of casing protects lubrication due to the pliable seal at each hub end.

Courtesy of Morse Chain Company

Figure 14 — Unassembled view of a Morse flexible silent chain coupling, showing from left to right the cover half, sprocket, silent chain, sprocket and cover half with felt seal.

with regard to the durability and life of a coupling as well as the performance of its lubricant. A flexible coupling is not intended to function as a universal joint and it should not be used as such. In other words, there are limitations as to the amount of initial misalignment which should be tolerated both from a parallel as well as an angular point of view.

Initial misalignment must be as low as possible otherwise there will be excessive motion between the coupling elements. In some gear type devices for example, this could lead to so much movement between the teeth as to cause generation of considerable heat. In case of inadequate lubrication ultimate breakage of relatively dry teeth could result.

VERTICAL COUPLINGS

When a lubricated type flexible coupling is to be installed in vertical position special provision must be made for complete circulation of lubricant. In gear type couplings designed for oil lubrication a center diaphragm can be installed between the hubs which are mounted on the upper and lower vertical shafts. A hardened steel button on this diaphragm bears on a hardened steel disc inserted in the upper end of the hub on the lower vertical shaft. The diaphragm thus serves as the bottom of an oil reservoir for the top half of the coupling. In other words, each half is lubricated separately by the oil with which the respective reservoirs are filled. Figure 2 illustrates such a coupling.

CONTINUOUS LUBRICATED COUPLINGS

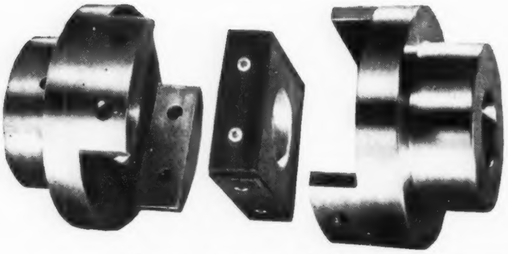
Lubrication of couplings such as the gear type also can be accomplished by oil circulation or what is termed continuous lubrication. This method of lubrication is particularly applicable where the coupling can be completely enclosed in a housing. Figures 2 and 4 indicate how hook-up to a circulating system can be made through a suitable oil inlet pipe. Discharge from the coupling drains into the housing for filtration (if necessary) and recirculation. Complete submergence of the coupling parts in oil is beneficial, both in the interest of lubrication as well as cooling. The prevailing flushing action also insures removal of moisture or solid contaminants.

LOW TEMPERATURE SERVICE

With the increased usage of low temperature machinery and the necessity for power driven units such as blowers, etc., to function under fairly continuous low temperatures, lubrication of flexible coupling elements under these conditions has become a research problem. Conventional greases or oils are suited to the normal range of temperatures which may include zero to 200 degrees Fahr. but

Courtesy of Morse Chain Company

Figure 15 — Assembled view of the Morse roller chain coupling with plastic cover.



Courtesy of American Flexible Coupling Company

Figure 16 — An "Oldham" type flexible coupling. This type of coupling does not require removal of flange bolts for disassembly.

when it is desired to locate a coupling in an atmosphere as low as −100 degrees Fahr. thinking must be revised as to the type of lubricant which will be most dependable. The question of adequate film strength is important at normal to high temperatures, but it becomes entirely subordinated to shear resistance at very low temperatures, especially on starting.

Recent study of pumpability characteristics of greases at low temperatures has developed some interesting indications as to the relation of shear resistance to penetration. In practical operation they relate in turn to the workability of a grease. Laboratory studies made at —40 degrees Fahr. have indicated that greases which show satisfactory working at this range would probably function successfully at even lower temperatures because the heat generated during operation should soften the grease sufficiently to enable it to provide adequate feeding and lubrication.

INSPECTION FOR LEAKAGE OR WEAR

Leakage of either grease or oil from any type of lubricated flexible coupling is objectionable; it can increase the cost of lubrication and result in a sloppy hazardous condition around the machine.

It is equally as important to seal the coupling against entry of abrasive foreign matter such as dust or dirt, corrosive liquid or gases. (See Figures 5 and 6). Abrasive materials in a coupling can materially impair the protective ability of the lubricating film. This can result in wear of the coupling parts to such an extent as to prevent the coupling from functioning properly. Actual leakage may result in case of severe wear.

For this reason periodic inspection is recommended. At the time of such an inspection the condition of the lubricant can be noted, abnormal misalignment between the connected machines can be corrected, and the coupling flushed if necessary. For this purpose a fairly light flushing oil is helpful. Heating is beneficial in enabling a flushing oil to remove oxidized lubricant or accumulations of gritty sludge.

SUMMARY

The several types of lubricated flexible couplings in use today, along with the wide range of service to which they are applied, present conditions which are not entirely conducive to specific lubrication recommendations. Lubrication is a phase of maintenance and as such it must be considered along with the maintenance requirements of the machinery to which the coupling is attached. In other words, if lubrication of coupling and machine can be timed and attended to concurrently, the operator is more apt to do a conscientious job on both. This of course brings the coupling builder into the picture and involves his methods of sealing and means for relubrication. His recommendations should be adhered to as closely as other considerations will allow.

Then there is the question of type of lubricant. Coupling builders have combined their field experience with their knowledge of lubrication to good advantage and their ideas as to this phase of maintenance are of much value to operators. Lately there has been additional thinking as to the benefits of additive type lubricants where conditions of severe load or relatively high temperatures are involved. The advantage of a certain amount of "Extreme Pressure" ability in the lubricant is accepted. Typical of this type of product are the mild "E.P." non-corrosive lead naphthenate lubricants which are so widely used today for the protection of industrial gears.

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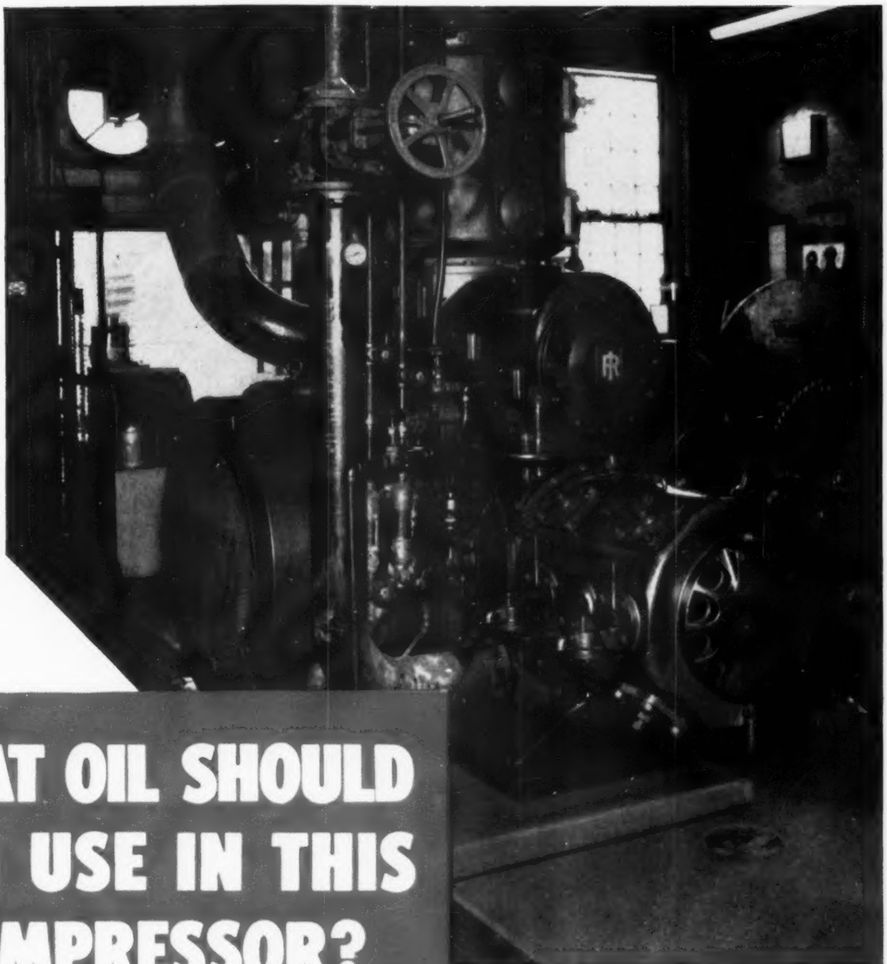

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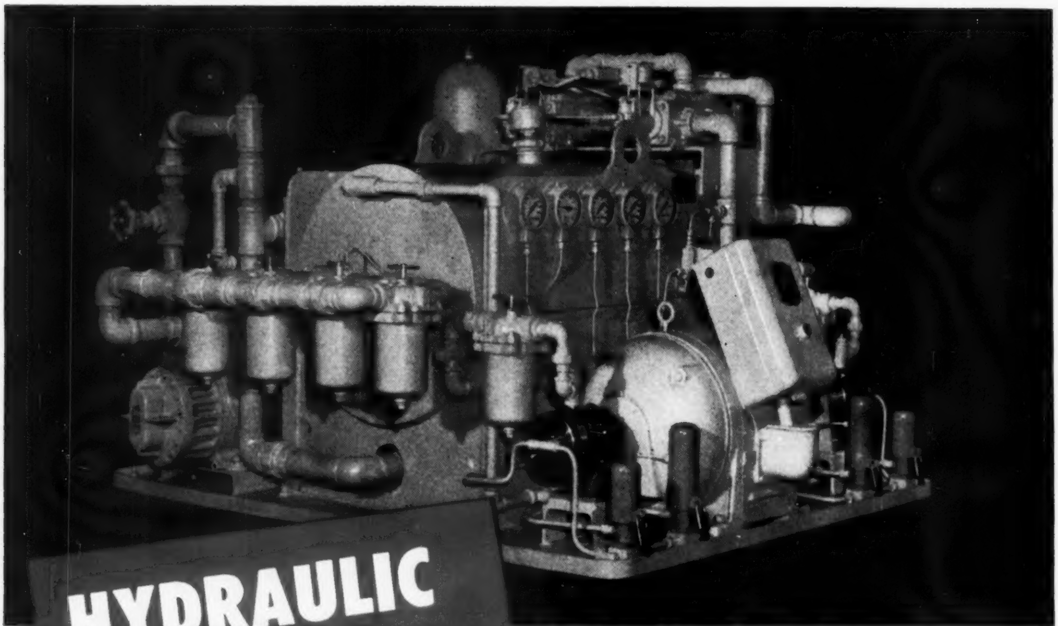

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